Suggested Session: Nuclear and Atomic Physics

DEVELOPMENT OF A METHOD TO MEASURE LOW-INTENSITY FAST-NEUTRON SOURCES

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Currently, there are many methods for measuring the neutron flux of large (>10^{10} n/s) neutron sources such as reactors. However, for smaller, fast-neutron sources, there is no standard method of determining neutron flux. Our group is developing applications using 14 MeV d-T electronic neutron generators with an average flux of 10^8 n/s. We have developed a new method of measuring neutron intensity for these low output fast-neutron devices by modifying American Society of Testing and Materials procedures.[1,2] We irradiate a 99.99% ^{27}Al foil (mass =5 g) for a period of 30 minutes. During this irradiation, ^{27}Mg ($t_{1/2}$ = 9.45 m) is produced through the ^{27}Al(n,p) reaction which has a cross-section of 72 mb at 14 MeV. After this irradiation, we then measure the activation of the foil for a similar period. By measuring the gamma rays from the first and second excited states of ^{27}Al, we can then calculate the reaction rate of ^{27}Mg. From this value, we can determine the total number of neutrons passing through the foil during irradiation. Our measured values of neutron output are in good agreement with those measured by the manufacturer of the d-T neutron generator.

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[1] *Annual Book of ASTM Standards,* "E 261-98 Standard Practice for Determining Neutron Fluence, Fluence Rate, and Spectra by Radioactivation Techniques" Vol. **12.02**, ASTM, West Conshohocken, PA, 2002, p.3.

[2] *Annual Book of ASTM Standards,* "E 266-02 Standard Test Method for Measuring Fast-Neutron Reaction Rates by Radioactivation of Aluminum" Vol. **12.02**, ASTM, West Conshohocken, PA, 2002, pp.2-3.